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ARRANGEMENTS

OF

VEGETABLE TISSUES AND ORGANS,

ANALYSES OF NATURAL ORDERS,

AND OTHER TABLES,

FOR THE USE OF STUDENTS OF BOTANY.

EDINBURGH, 1846.

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ARRANGEMENTS

OF

VEGETABLE TISSUES AND ORGANS, ANALYSES OF NATURAL ORDERS, AND OTHER TABLES, FOR THE USE OF STUDENTS OF BOTANY.

I.—Various Forms of Cellular Tissue.

1. Dodecahedral Cellular tissue (*Hexagonienchyma*), called by some true *Parenchyma,* seen in the pith of some plants. 2. Elliptical, Oval, and Spherical (*Merenchyma, Ovenchyma,* and *Sphærenchyma*), common in herbaceous plants. 3. Cubical (*Cubenchyma*), seen in the Gourd. 4. Columnar, divided into Cylindrical (*Cylindrenchyma*), seen in Chara; and Prismatical (*Prismenchyma*), seen in the bark of plants. Prismatical when compressed becomes Muriform, as in the medullary rays of woody stems. 5. Conical (*Conenchyma*), in hairs. 6. Fusiform or Spindle-shaped (*Prosenchyma* or *Atractenchyma*), seen in Misleto. 7. Stellated or Star-like (*Actinenchyma*), seen in Musa, and in the hairs of Deutzia scabra. 8. Sinuous (*Colpenchyma*), in the cuticle of leaves. 9. Branched (*Cladenchyma*), in some hairs. 10. Tabular (*Pinenchyma*), in the outer bark. 11. Entangled (*Dædalenchyma*), in some Fungi as Amanita muscaria.

II.—Arrangement of Vegetable Tissues.

A. Cellular Tissue (Parenchyma), composed of membrane or of membrane and fibre, in the form of cells whose length does not greatly exceed their breadth.

  1. Membranous, formed by membrane alone.

  2. Fibrous (Inenchyma), formed by membrane and fibre; occasionally, according to some, formed by fibre alone.

    a. Porous Cells (Articulated Bothrenchyma or Taphrenchyma), or Cells with pits or depressions on their walls.

    b. Dotted Cells, or Cells with opaque spots which are probably portions of fibre.

B. Vascular or Tubular Tissue (Angienchyma), composed of cylindrical tubes, which are continuous, and overlie each other at the ends.

  I. Membranous Vascular Tissue, composed of tubes which are not marked by fibres or dots.

    1. Ligneous Tissue (Pleurenchyma), composed of fusiform tubes with thickened walls.

    2. Laticiferous Tissue (Cinenchyma), composed of tubes which anastomose, and convey a peculiar fluid called Latex.

- II. Fibro-Vascular Tissue, composed of tubes which are marked by fibres or dots.
  - *a.* True Fibro-Vascular Tissue, composed of tubes, with complete fibres inside.
    - 1. Spiral Vessels (Tracheæ, Trachenchyma), having a perfect spiral fibre coiled up in their interior.
    - 2. Annular Vessels or Ducts, having a fibre in the form of a ring.
    - 3. Moniliform Vessels or Ducts, exhibiting successive contractions and dilatations, and having a perfect fibre inside.
  - *b.* Spurious Fibro-Vascular Tissue, composed of tubes marked by dots or lines, but without a complete fibre inside.
    - 4. Scalariform Vessels, having their walls marked by bars in the form of a ladder.
    - 5. Reticulated, having their walls marked by reticulated fibres.
    - 6. Porous Vessels (Continuous Bothrenchyma or Taphrenchyma), having their walls marked by pits or depressions.
    - 7. Dotted Vessels (Glandular Woody Tissue), having opaque spots on their walls, surrounded by circular disks.

III.—DIFFERENT FORMS OF INFLORESCENCE OR ANTHOTAXIS.

- A. Flowers Sessile.
  - I. Floral Axis elongated.
    - 1. Axis permanent.
      - Spike (Plantago), Locusta or Spikelet (Lolium), Spadix (Arum), Cone (Fir), Strobilus (Hop.)
    - 2. Axis deciduous.
      - Catkin or Amentum (Willow), Compound Catkin (Male flowers of Fir.)
  - II. Floral Axis shortened or depressed (a Receptacle.)
    - Capitulum or Anthodium (Dandelion.)
- B. Flowers Pedicellate.
  - I. Floral Axis elongated.
    - 1. Peduncles simple.
      - *a.* of equal or nearly equal length.
        - Raceme (Currant, Hyacinth.)
      - *b.* lowermost longest.
        - Centripetal expansion—Corymb (Ornithogalum.)
        - Centrifugal expansion—Fascicle (Pink.)
    - 2. Peduncles branched.
      - Panicle (Poa), Thyrsus (Lilac), Anthela (Luzula), Compound Raceme (Plane-tree), Compound Corymb (Milfoil.)
  - II. Floral Axis shortened or depressed.
    - 1. Expansion centripetal.
      - *a.* Peduncles very short, Flowers forming a close head.
        - Glomerulus (Armeria, Echinops.)
      - *b.* Peduncles nearly equal, radiating from a common centre.
        - Peduncles simple—Simple Umbel (Astrantia, Ramsons.)
        - Peduncles branched—Compound Umbel (Hemlock.)
    - 2. Expansion centrifugal.
      - *a.* Peduncles simple—Verticillaster (Lamium.)
      - *b.* Peduncles branched—Cyme (Elder.)

IV.—ARRANGEMENT OF FRUITS.

A. Simple Fruits formed from a single flower, and consisting of one or of several Carpels; including Apocarpous, Aggregate, and Syncarpous Fruits.

I. Indehiscent Pericarps.

1. Usually containing a single seed;

Covered by a dry simple Pericarp.	Separable from the seed,	Achænium (Lithospermum.) (*Mericarp* and *Cremocarp* in Umbelliferæ, and *Cypsela* in Compositæ.)
	Achænia inclosed in fleshy tube of Calyx,	*Cynarrhodum* (Rose.)
	Inseparable from the seed,	Caryopsis (Grasses.)
	Inflated	Utricle (Chenopodium.)
	Having a cupulate involucrum,	Glans (Acorn.)
	Having winged appendages,	Samara (Sycamore.)
Covered by a Pericarp, consisting of Epicarp, Sarcocarp, and Endocarp,		Drupa (Cherry.)
	Drupe with a two-valved Endocarp,	*Tryma* (Walnut.)
	Aggregate Drupes,	*Etærio* (Raspberry.)

2. Containing two or more seeds;

Immersed in a Fleshy Mass.	Rind formed of Calyx, Placenta parietal, attachment of seeds lost when ripe,	Bacca (Gooseberry.)
	——————— attachment permanent, rind thick and hard,	Pepo (Gourd.)
	Rind not formed of Calyx, Placenta central,	Nuculanium (Grape.)
	Having a spongy separable rind, and separable pulpy cells,	Hesperidium (Orange.)
Enclosed in dry cells, which are covered by a fleshy Pericarp,		Pomum (Apple.)

II. Dehiscent Pericarps.

Seeds in a Dry Pericarp.	Opening by Ventral Suture only,	Follicle (Pæony.)
	Opening by Ventral and Dorsal Suture,	Legume (Pea.)
	Lomentum, a peculiar indehiscent Legume,	(Birdsfoot.)
	Opening by two valves which separate from a Central Replum or Frame,	Siliqua (Cabbage.) Silicula (Capsella.)
	Opening by Transverse or Circumscissile Dehiscence,	Pyxidium (Henbane.)
	Opening by several valves or pores, without Ventral or Dorsal Suture or Replum,	Capsule (Poppy.)
	Opening by elastic cocci,	Regma (Hura.)

B. Multiple or Anthocarpous Fruits, formed by the union of several Flowers, and consisting of Floral Envelopes, as well as Ovaries.

Hollow Anthocarpous Fruit.—Syconus (Fig).
Convex Anthocarpous Fruit,
- formed by Indurated Catkin.—Strobilus (Fir Cone).
- formed by Succulent Spike.—Sorosis (Bread-Fruit).

V.—GENERAL ARRANGEMENT OF THE ORGANS OF PHANEROGAMOUS PLANTS.

I.—Elementary Organs.

Membrane,
Fibre,
- Vesicles or Cellules, — Cellular Tissue.
- Spiral Vessels or Tracheæ,
- Ducts or Tubes, — Vascular Tissue.

II.—Compound Organs.

Cuticle or Pellicle,
Stomata, — Epidermis.
Hairs, Prickles, Stings, Glands.

Nutritive Compound Organs.

Spongioles,
Fibrils, — Roots.

Pith,
Medullary Sheath,
Heartwood or Duramen,
Sapwood or Alburnum,
Medullary Rays or Plates,
Liber or Endophloeum,
Cortical Layers or Epi- and Mesophloeum, — Stems and Branches.

Thorns.
Bulbs.
Tubers.
Suckers.
Runners.
Rhizome.
Corm.

Petiole,
Limb, — Leaf.

Stipules.

Phyllodia.
Tendrils.
Ascidia.

Reproductive Compound Organs.

Bractea.

Involucrum.

Sepals—Calyx,
Petals—Corolla, — Perianth or Perigone,

Fovilla granules, — Pollen grains, — Anther,
Filament, — Stamens,

Carpels,
Ovules, — Ovary,
Style,
Stigma, — Pistil, — Flower.

Composition of Ripe Fruit.

		Pericarp,	Fruit.
Radicle, Cotyledon, Plumule,	Embryo,	Seed,	
	Spermoderm or Perisperm, Albumen,		

VI.—LINNÆAN ARRANGEMENT.

CLASSES OF THE LINNÆAN SYSTEM.

A. Flowers Conspicuous (Phanerogamia.)		
I. Stamens and Pistil in every flower.		
1. Stamens Free.		
a. Stamens of equal length, or not differing in certain proportions;		
in Number 1,	...	Class I. Monandria.
— 2,	...	II. Diandria.
— 3,	...	III. Triandria.
— 4,	...	IV. Tetrandria.
— 5,	...	V. Pentandria.
— 6,	...	VI. Hexandria.
— 7,	...	VII. Heptandria.
— 8,	...	VIII. Octandria.
— 9,	...	IX. Enneandria.
— 10,	...	X. Decandria.
—12-19,	...	XI. Dodecandria.
— 20 or more,	Inserted on Calyx,	XII. Icosandria.
	——————Receptacle,	XIII. Polyandria.
b. Stamens of different lengths;	Two long and two short,	XIV. Didynamia.
	Four long and two short,	XV. Tetradynamia.
2. Stamens United;		
by Filaments in one bundle,		XVI. Monadelphia.
—————— in two bundles,		XVII. Diadelphia.
—————— in more than two bundles,		XVIII. Polyadelphia.
by Anthers (Compound flowers,)		XIX. Syngenesia.
with Pistil on a Column,		XX. Gynandria.
II. Stamens and Pistil in different flowers,	On the same Plant,	XXI. Monœcia.
	On different Plants,	XXII. Diœcia.
III. Stamens and Pistil in the same or in different flowers on the same or on different plants,		XXIII. Polygamia.
B. Flowers Inconspicuous,		XXIV. Cryptogamia.

Orders of the Linnæan System.

Class I.	Monogynia,	1 Style.
II.	Digynia,	2 Styles.
III.	Trigynia,	3 —
IV.	Tetragynia,	4 —
V.	Pentagynia,	5 —
VI.	Hexagynia,	6 —
VII.	Heptagynia,	7 —
VIII.	Octogynia,	8 —
IX.	Enneagynia,	9 —
X.	Decagynia,	10 —
XI.	Dodecagynia,	12–19 Styles.
XII.	Polygynia,	20 and upwards.
XIII.		
XIV.	Gymnospermia,	Fruit formed by four Achænia.
	Angiospermia,	Fruit, a two-celled Capsule, with many seeds.
XV.	Siliculosa,	Fruit, a Silicula.
	Siliquosa,	Fruit, a Siliqua.
XVI. XVII. XVIII.	Triandria, &c. (number of Stamens,) as in the Classes.	
XIX.	Polygamia Æqualis,	Florets all hermaphrodite.
	——— Superflua,	Florets of the disk hermaphrodite, those of the ray pistilliferous and fertile.
	——— Frustranea,	Florets of the disk hermaphrodite, those of the ray neuter.
	——— Necessaria,	Florets of the disk staminiferous, those of the ray pistilliferous.
	——— Segregata,	Each floret having a separate involucre.
	Monogamia,	Anthers united, flowers not compound.
XX. XXI. XXII.	Monandria, &c. (number of Stamens,) as in the Classes.	
XXIII.	Monœcia,	Hermaphrodite, staminiferous, and pistilliferous flowers—on the same plant.
	Diœcia,	on two plants.
	Triœcia,	on three plants.
XXIV.	Filices,	Ferns.
	Musci,	Mosses.
	Hepaticæ,	Liverworts.
	Lichenes,	Lichens.
	Algæ,	Sea-weeds.
	Fungi,	Mushrooms.

VII.—Classes of Jussieu's System.

Acotyledones,		Class I.
Monocotyledones,	Mono-hypogynæ, (Stamens hypogynous,)	II.
	Mono-perigynæ, (——— perigynous,)	III.
	Mono-epigynæ, (——— epigyonus,)	IV.

Dicotyledones.	Monoclines, Flowers hermaphrodite.			
	Apetalæ, (No petals.)	Epistamineæ,	(Stamens epigynous,)	V.
		Peristamineæ,	(——— perigynous,)	VI.
		Hypostamineæ,	(——— hypogynous,)	VII.
	Monopetalæ, (Petals united.)	Hypocorollæ,	(Corolla hypogynous,)	VIII.
		Pericorollæ,	(——— perigynous,)	IX.
		Epicorollæ,	((Corolla epigynous,) Synantheræ, (Anthers united.)	X.
			Corisantheræ, (Anthers free.)	XI.
	Polypetalæ, (Petals distinct.)	Epipetalæ,	(Petals epigynous,)	XII.
		Peripetalæ,	(——— perigynous,)	XIII.
		Hypopetalæ,	(——— hypogynous,)	XIV.
	Diclines,	Flowers unisexual,		XV.

Under these Classes Jussieu included 100 Orders.

VIII.—Classes of the Natural System of Decandolle.

Class I. Dicotyledones or Exogenæ.

Dichlamydeæ, having Calyx and Corolla.	Subclass 1.	Thalamifloræ, Petals distinct, Stamens hypogynous.
	——— 2.	Calycifloræ, Petals distinct, Stamens perigynous.
	——— 3.	Corollifloræ, Petals united, bearing the Stamens.
Having a single Perianth.	——— 4.	Monochlamydeæ, A Calyx only, or none.

Class II. Monocotyledones or Endogenæ.

Subclass 1.	Petaloideæ or Floridæ,	Floral envelopes verticillate.
——— 2.	Glumaceæ,	Floral envelopes imbricated.

Class III. Acotyledones or Acrogenæ.

Subclass 1.	Ætheogamæ,	Semivascular.
——— 2.	Amphigamæ,	Cellular.

IX.—Division of the Vegetable Kingdom by Lindley. 1839.

Exogens.	Cyclogens, (Wood in circles,)	Class I. Exogens (proper.) II. Gymnogens (naked seeds.)
	Wood in wedges,	III. Homogens.
Endogens.	Spermogens, (Bearing seeds,)	IV. Dictyogens (leaves reticulated.) V. Endogens (proper.)
	Bearing spores,	VI. Sporogens or Rhizanths.
Acrogens.	Distinct Stem,	VII. Cormogens.
	Only a Thallus,	VIII. Thallogens.

In the Exogens and Endogens, the following subordinate series of Subclasses are formed:—

1. Consolidated. Floral envelopes are united both with each other and the Stamens, and with the Ovary.

2. Separated. Floral envelopes and Stamens are united to each other, but the Ovary is consolidated and free.
3. Adherent. Petals and Sepals adhere to each other and the Stamens and Ovary, but have their parts disunited.
4. Disunited. Petals and Sepals adhere to each other and the Stamens, but have their parts disunited, and do not adhere to the consolidated Ovary.
5. Dissolved. Petals and Sepals are distinct from the Stamens, and also from the Ovary, whose Carpels are disunited, either wholly or by the Styles.

In each of these Subdivisions, the Orders are arranged in two series, the one Albuminous, the other Exalbuminous.

X.—LINDLEY'S DIVISION OF THE VEGETABLE KINGDOM. 1845.

ASEXUAL OR FLOWERLESS PLANTS.

Stem and leaves undistinguishable, Class I. Thallogens.
Stem and leaves distinguishable, II. Acrogens.

SEXUAL OR FLOWERING PLANTS.

Fructification springing from a thallus, III. Rhizogens.
Fructification springing from a stem.
  Wood of stem youngest in the centre, cotyledon single.
    Leaves parallel-veined, permanent, wood of stem always confused, IV. Endogens.
    Leaves net-veined, deciduous, wood of stem, when perennial, arranged in a circle with a central pith, V. Dictyogens.
  Wood of stem youngest at the circumference, always concentric, cotyledons two or more.
    Seeds quite naked, VI. Gymnogens.
    Seeds inclosed in seed-vessels, VII. Exogens.

The following are the Subclasses of Endogens or Exogens adopted by Lindley.

ENDOGENS.

Subclass 1. Glumaceous.—Floral envelopes imbricated.
——— 2. Petaloid.—Floral envelopes verticillate.
  a. Unisexual often achlamydeous.
  b. Hermaphrodite, ovary adherent.
  c. Hermaphrodite, ovary free.

EXOGENS.

Subclass 1. Diclinous.—Flowers unisexual.
——— 2. Hypogynous.—Flowers usually hermaphrodite, stamens completely hypogynous, free from the calyx or corolla.
——— 3. Perigynous.—Flowers usually hermaphrodite, stamens growing to the side of either the calyx or corolla; ovary superior or nearly so.

Subclass 4. Epigynous.—Flowers usually hermaphrodite, stamens growing to the side of either the calyx or corolla; ovary inferior, or nearly so.

Under the Classes Lindley enumerates 56 Alliances and 303 Natural Orders.

XI.—ANALYSIS OF THE CHIEF ORDERS IN THE CLASS DICOTYLEDONES,

SUBCLASS THALAMIFLORÆ.

I. Polyandrous, (stamens indefinite, more than twenty.)
  1. Leaves exstipulate (without stipules.)
    Leaves forming pitchers, stigma umbrella-like.—*Sarraceniaceæ.*
    Leaves not forming pitchers.
    a. Stamens distinct (free or not united.)
      Sepals and petals definite.
        Albumen absent.
          Anthers adnate, stigmas sessile.—*Guttiferæ* or *Clusiaceæ,* fruit sometimes eatable (Mangosteen,) purgative acrid juice (Gamboge.)
          Anthers versatile, stigmas on a long style.—*Ternstrœmiaceæ,* stimulating (Tea.)
        Albumen ruminate.—*Anonaceæ,* aromatic, fruit eatable (Custard apple.)
        Albumen uniform.
          Carpels distinct, sap transparent.—*Ranunculaceæ,* acrid, narcotic, poisonous (Black Hellebore and Aconite.)
            Suborder: *Podophylleæ,* cathartic.
          Carpels united, sap milky.—*Papaveraceæ,* narcotic (Poppy, Opium.)
      Sepals and petals numerous, passing into each other.—*Nymphæaceæ,* slightly astringent (Water-lily.)
    b. Stamens polyadelphous.—*Hypericaceæ,* resinous, purgative (Vismia.)
  2. Leaves stipulate.
    a. Calyx persistent.
      Sepals imbricate.
        Anthers two-celled.
          Sepals irregular.—*Cistaceæ,* balsamic (Labdanum.)
          Sepals equal—*Flacourtiaceæ,* purgative and stomachic (Arnotto.)
      Sepals valvate.
        Anthers monadelphous.
          One-celled.—*Malvaceæ,* mucilaginous (Marsh Mallow.)
          Two-celled.
            Stamens columnar, extrorse.—*Sterculiaceæ,* mucilaginous.
            Stamens not columnar, introrse.—*Byttneriaceæ,* mucilaginous and Stimulant (Chocolate.)
        Anthers free.—*Tiliaceæ,* demulcent (Lime-tree.)
    b. Calyx deciduous.
        Leaves with transparent dots.—*Winteraceæ,* aromatic stimulant (Winter's-bark.)
        Leaves without dots.—*Magnoliaceæ,* bitter, tonic.

II. Oligandrous, (stamens definite, less than twenty.)
  1. Leaves stipulate, carpels consolidated.
    a. Placentæ parietal.
      Petals five.
        Leaves with circinnate vernation, stipules fringed.—*Droseraceæ*, acrid (Sun-dew.)
        Leaves with involute vernation, stipules not fringed.— *Violaceæ*, emetic (White Ipecacuan.)
      Petals more than five, lacerated.—*Resedaceæ*, fragrant (Mignionette.)
    b. Placentæ central.
      Fruit beaked, gynobasic, separating into five coccoons.—*Geraniaceæ*, astringent.
      Fruit without a beak.
        Albumen absent.—*Sapindaceæ*, leaves poisonous (Buck-Eye,) fruit edible (Litchi, Longan, Guarana.)
        Albumen present.
          Stamens more or less united, and alternate with petals.—*Oxalidaceæ*, acid (Wood-sorrel.)
          Stamens not united, opposite the petals.— *Vitaceæ*, fruit eatable (Vine.)
  2. Leaves exstipulate.
      Carpels distinct.
        Anthers opening by recurved valves, fruit a berry or capsule.—*Berberidaceæ*, acid (Barberry.)
        Opening of anthers not valvular, fruit a samara.—*Aceraceæ*, saccharine (Sugar-maple.)
      Carpels united into one.
        Stamens tetradynamous.—*Cruciferæ* or *Brassicaceæ*, pungent, stimulant (Mustard.)
        Stamens mon- or di- adelphous.
          Sepals five, two larger coloured.—*Polygalaceæ*, stimulant, astringent (Senega, Rhatany.)
          Sepals two, deciduous.—*Fumariaceæ*, diaphoretic, aperient.
        Stamens neither tetradynamous nor united.
          Seeds exalbuminous.
            Leaves dotted.—*Aurantiaceæ*, pulp of fruit more or less acid, plants yield oil (Lemon, Orange, Citron.)
            Leaves not dotted.—*Capparidaceæ*, stimulant (Capers.)
          Seeds albuminous.
            Styles distinct, leaves not dotted.—*Caryophyllaceæ*, inert.
            Styles united, leaves dotted.—*Rutaceæ*, bitter, anthelmintic (Rue,) antispasmodic (Bucku,) febrifuge (Angustura.)

XII.—ANALYSIS OF THE CHIEF ORDERS IN THE CLASS DICOTYLEDONES.

SUBCLASS CALYCIFLORÆ.

I. Carpels distinct or but slightly adherent, each having a style and stigma.
  1. Leaves stipulate.

a. Leaves without dots.

Carpels numerous, distinct (if solitary not a legume.)—***Rosaceæ,*** astringent (Rose.)

Suborder: *Pomeæ,* fruit eatable (Apple, Pear.)

——— *Amygdaleæ,* fruit eatable (a Drupe,) bark tonic; prussic acid (Peach, Cherry-laurel.)

——— *Sanguisorbeæ,* astringent (Burnet.)

Carpel solitary, a legume.—***Leguminosæ,*** leaves and fruit eatable (Pulse.)

Suborder: *Papilionaceæ,* nutritive (Beans and Peas.)

——— *Cæsalpinieæ,* purgative (Senna.)

——— *Mimoseæ,* astringent, mucilaginous (Catechu, Gum.)

b. Leaves with dots.

Plants abounding in balsamic juice.—***Anacardiaceæ*** or ***Terebinthaceæ,*** resinous, acrid, and astringent, fruit sometimes eatable (Cashew, Sumach, Mango.)

2. Leaves exstipulate.

Styles two.—***Saxifragaceæ,*** astringent (Saxifrages.)

Styles more than two.—***Crassulaceæ,*** acrid (Stonecrop.)

II. Carpels united, forming an inferior ovary.

1. Flowers with a coronet or ring of abortive stamens.

Plants with stinging hairs, leaves exstipulate.—***Loasaceæ,*** irritant (Chili-nettle.)

Plants without stinging hairs, leaves stipulate.—***Passifloraceæ,*** subacid (Granadilla.)

2 Flowers without a coronet or ring of abortive stamens.

a. Placentæ central.

Leaves with pellucid dots.—***Myrtaceæ,*** aromatic, stimulant, bark astringent (Cajeput, Cloves.)

Leaves without pellucid dots.

Stamens indefinite.—***Lecythidaceæ,*** seeds eatable (Brazil-nuts.)

Stamens definite.—***Onagraceæ,*** mucilaginous (Willow-herb.)

b. Placentæ parietal.

Flowers monœcious or diœcious.

Stem climbing by tendrils, herbs.—***Cucurbitaceæ,*** purgative (Colocynth and Elaterium,) eatable (Melon and Gourd.)

Stem not climbing by tendrils, trees.—***Papayaceæ,*** fruit eatable (Papaw.)

Flowers hermaphrodite.

Petals indefinite.—***Cactaceæ,*** subacid (Indian Fig.)

Petals definite.

Ovary one-celled.—***Grossulaceæ,*** fruit eatable (Gooseberry and Currant.)

Ovary two-celled, stem hollow, flowers in umbels.—***Umbelliferæ*** or ***Apiaceæ,*** herb poisonous (Hemlock,) stimulant and eatable (Parsley, Parsnep,) fruit aromatic (Caraway.)

XIII.—ANALYSIS OF THE CHIEF ORDERS IN THE CLASS DICOTYLEDONES,

SUBCLASS COROLLIFLORÆ.

I. Corolla Epigynous.
  Anthers dehiscing by pores.— *Vacciniaceæ*, acid (Cranberry.)
  Anthers not dehiscing by pores.
    Ovary one-celled, anthers syngenesious.—*Compositæ*, bitter (Chamomile, Thistle,) narcotic (Lettuce.)
      Suborder: *Cynarocephalæ*, receptacle eatable (Artichoke.)
      ———— *Cichoraceæ*, milky, diuretic, and narcotic (Dandelion, Lactucarium.)
      ———— *Corymbiferæ*, bitter (Chamomile.)
      ———— *Labiatifloræ*, bitter (Mutisia.)
    Ovary two or more celled.
      Leaves opposite.
        Interpetiolary stipules.—*Cinchonaceæ*, febrifuge (Jesuit's Bark,) emetic (Ipecacuan,) stimulant (Coffee.)
        Without stipules.—*Caprifoliaceæ*, (Honeysuckle, Snowberry.)
      Leaves whorled.—*Galiaceæ* or *Stellatæ*, dye (Madder.)
      Leaves alternate.—*Campanulaceæ*, slightly acid (Hare-bell.)

II. Corolla hypogynous.
  1. Flowers regular, stamens equal in length, or at least not didynamous.
    Ovary four-lobed externally, fruit four achænia.—*Boraginaceæ*, mucilaginous (Borage,) dye (Alkanet.)
    Ovary undivided.
      Carpels four, five, or more.
        Stamens opposite petals.—*Primulaceæ*, acrid and sedative (Primrose and Cowslip.)
        Stamens alternate with petals.
          Anthers opening by pores.
            Two-celled and with appendages.—*Ericaceæ*, astringent (Erica,) narcotic (Rhododendron.)
            One-celled, no appendage.—*Epacridaceæ*, fruit of some eatable (Lissanthe.)
          Anthers not opening by pores.
            Twining plants, corolla plaited, embryo curved.—*Convolvulaceæ*, purgative (Jalap, Scammony.)
            Leafless plants, corolla not plaited, embryo spiral.—*Cuscutaceæ*, acrid (Dodder.)
      Carpels only two.
        Stamens two.—*Oleaceæ*, laxative (Olive.)
        Stamens four or five.
          Leaves opposite.
            Single one-celled ovary.—*Gentianaceæ*, bitter tonic (Gentian.)
            Two-celled ovary, or two ovaries or follicles.
              Filaments distinct, pollen granular, seeds not hairy.—*Apocynaceæ*, milk and fruit poisonous (Nux Vomica,) bark sometimes febrifuge.

Filaments united to style, pollen in masses, seeds hairy.—*Asclepiadaceæ,* acrid, emetic (Mudar.)
Leaves alternate.—*Solanaceæ,* poisonous, narcotic (Belladonna, Henbane.)
2. Flowers irregular, stamens didynamous, sometimes only two.
Ovary four-lobed externally, fruit four achænia.—*Labiatæ,* tonic, stomachic (Mint.)
Ovary undivided.
Stems leafless, habits parasitic.—*Orobanchaceæ,* astringent (Broom-rape.)
Stems leafy, not parasitic.
Capsule two-celled.
Seeds attached to placentæ by hard, usually hooked processes. —*Acanthaceæ,* emollient (Acanthus.)
Seeds without hard or hooked stalks.—*Scrophulariaceæ,* suspicious, sedative (Digitalis.)
Capsule one-celled.—*Gesneraceæ,* succulent, fruit eatable (Gesnera.)

XIV.—Analysis of the chief Orders in the Class Dicotyledones,

Subclass Monochlamydeæ.

A. Angiospermæ, seeds in an ovary.

I. Ovary inferior, or partially so.
1. Flowers in catkins.
Seeds hairy, fruit without a cupula.—*Salicaceæ,* bitter tonic, febrifuge (Willow.)
Seeds not hairy.
Fruit with a cupula.—*Cupuliferæ* or *Corylaceæ,* bark astringent (Oak.)
Fruit membranaceous, indehiscent.—*Betulaceæ,* astringent, (Birch.)
Amentaceæ.
2. Flowers not in catkins.
Flowers hermaphrodite.
Ovary with a single ovule.—*Chenopodiaceæ,* wholesome, insipid (Spinach.)
Ovary with more than one ovule.—*Aristolochiaceæ,* tonic, stimulating (Aristolochia.)
Flowers unisexual.—*Begoniaceæ,* astringent, bitter (Begonia.)

II. Ovary superior.
1. Flowers hermaphrodite.
Anthers opening by four recurved valves.—*Lauraceæ,* aromatic (Cinnamon.)
Anthers not opening by recurved valves.
Flowers naked or achlamydeous.—*Piperaceæ,* condiments (Pepper,) astringent (Matico.)

Flowers with a calyx.
  Stamens placed on lobes of calyx, no stipules.—*Proteaceæ,* fruit sometimes eaten (Avellano,)
  Stamens not placed on lobes of calyx, ochreate stipules.—*Polygonaceæ*, acid (Sorrel,) purgative (Rhubarb.)

2. Flowers unisexual.
  Carpels more than one united into a solid pistil.
    Leaves forming pitchers, wood without zones, fruit four-celled.—*Nepenthaceæ*, subacid fluid in pitchers (Pitcher-plant.)
    Leaves not forming pitchers, wood with zones, fruit tricoccous.—*Euphorbiaceæ*, acrid, stimulant, poisonous (Castor oil, Croton oil, Cascarilla.)
  Carpels solitary or separate.
    Fruit a Drupe.
      Without arillus, nucleus in form of horse-shoe.—*Menispermaceæ*, root bitter and tonic (Calumba,) fruit bitter narcotic (Cocculus indicus.)
      With arillus, nucleus not curved.—*Myristicaceæ*, aromatic (Nutmeg.)
    Fruit a nut.—*Urticaceæ*, narcotic, tough fibres (Hop, Hemp.)
      Suborder: *Moreæ*, eatable fruit (Mulberry.)
      ———— *Artocarpeæ*, milky juice, poisonous (Upas,) fruit eatable (Fig and Bread-fruit.)

B. Gymnospermæ, seeds naked.

  Stem terminated by a single bud, leaves pinnate, with circinnate vernation.—*Cycadaceæ*, amylaceous (Cycas.)
  Stem bearing many buds, leaves simple, not circinnate.
    Females in cones.—*Coniferæ* or *Pinaceæ,* turpentine, pitch (Fir, Spruce.)
      Suborder: *Cupressineæ*, acrid oil (Savin.)
    Females solitary.—*Taxaceæ,* resinous, leaves and seeds dangerous (Yew.)

XV.—ANALYSIS OF THE CHIEF ORDERS IN THE CLASS MONOCOTYLEDONES.

SUBCLASS 1.—DICTYOGENÆ.

Ovary inferior.—*Dioscoreaceæ*, acrid, sometimes eatable (Yam.)
Ovary superior.
  Petals six.—*Smilaceæ*, demulcent, diuretic (Sarsaparilla.)
  Petals three.—*Trilliaceæ*, narcotic, emetic (Herb Paris.)

SUBCLASS 2.—PETALOIDEÆ OR FLORIDÆ.

A. Flowers complete, having a perianth.

I. Ovary inferior.

1. Veins diverging from midrib.
Monandrous.
Anthers two-celled.—*Zingiberaceæ* or *Scitamineæ*, aromatic, stimulating (Ginger.)
Anthers one-celled.—*Marantaceæ*, amylaceous (Arrow-root.)
Hexandrous.—*Musaceæ*, fruit nutritious (Banana and Plantain.)
2. Veins parallel with the midrib.
Flowers gynandrous.—*Orchidaceæ*, aromatic, mucilaginous (Vanilla, Orchis, Salep.)
Flowers not gynandrous.
Triandrous, anthers extrorse.—*Iridaceæ*, aromatic (Orris-root.)
Hexandrous, anthers introrse.
Sepals petaloid.—*Amaryllidaceæ*, some poisonous (Hæmanthus.)
Sepals green or scaly, plants scurfy.—*Bromeliaceæ*, acid fruit (Pine-apple.)
II. Ovary superior.
1. Sepals petaloid.
Flowers on a spadix, seeds solitary.—*Palmæ*, amylaceous, saccharine (Sago, Coco-nut.)
Flowers not on a spadix, seeds numerous.
Anthers introrse, styles united.—*Liliaceæ*, bitter, stimulant, purgative (Squill, Onion, Aloes.)
Anthers extrorse, styles distinct.—*Melanthaceæ*, cathartic, narcotic, diuretic (Colchicum.)
2. Sepals green or scaly.
Carpels separate.—*Alismaceæ*, aquatic plants, acrid (Alisma.)
Carpels united.—*Juncaceæ*, used for mats (Rushes.)

B. Flowers incomplete, without any perianth or with a few verticillate scales.
1. Flowers on a spadix.
Unisexual.
Anthers sessile, vernation convolute.—*Araceæ* or *Aroideæ*, acrid, poisonous, also amylaceous (Arum, Dumb-cane, Portland Sago.)
Anthers stalked.
Fruit, a fibrous drupe or a berry.—*Pandanaceæ*, seeds edible (Screw-pine.)
Fruit dry, anthers clavate with slender filaments.—*Typhaceæ*, astringent, yield starch (Bulrush or Reed-mace.)
Hermaphrodite.—*Orontiaceæ*, aromatic (Sweet-flag,) fœtid (Skunk Cabbage,) acrid (Calla.)
2. Flowers not on a spadix.
Terrestrial plants.—*Juncaginaceæ*, styptic (Arrow-grass.)
Aquatic plants.—*Pistiaceæ*, acrid (Duckweed.)

SUBCLASS 3.—GLUMACEÆ.

Stems fistular, sheaths split.—*Gramineæ*, fruit yields flower (Corn,) herbage sweet (Sugar-cane.)
Stems solid, and sheaths entire.—*Cyperaceæ*, diaphoretic (German Sarza.)

SUBCLASS 4.—RHIZANTHÆ OR RHIZOGENÆ.

Ovules numerous, anthers opening by pores.—*Rafflesiaceæ*, styptic (Rafflesia.)
Ovules solitary, pendulous, anthers without pores.—*Balanophoraceæ*, styptic (Fungus melitensis.)

XVI.—ANALYSIS OF THE NATURAL ORDERS IN THE CLASS ACOTYLEDONES.

SUBCLASS 1.—ÆTHEOGAMÆ OR CORMOGENÆ.

1. Plants with a distinct axis of growth.
  Spores with elaters.
    In valvular thecæ.—*Jungermanniaceæ* (Scale-mosses.)
    Naked, in cones.—*Equisetaceæ*, yield silica (Horsetails.)
  Spores without elaters.
    Thecæ on the leaves.—*Filices*, astringent, pectoral, some eatable (Ferns.)
    Thecæ in the axil of the leaves.
      Sessile.—*Lycopodiaceæ*, emetic, purgative (Club-moss.)
      Stalked.—*Musci*, astringent, diuretic (Mosses.)
2. Plants without a distinct axis of growth.
  Spores without elaters.—*Ricciaceæ* (Crystal-worts.)
  Spores with elaters.—*Hepaticæ*, used in dropsy (Liverworts.)

SUBCLASS 2.—THALLOGENÆ OR AMPHIGENÆ.

Having a mycelium or spawn.—*Fungi*, stimulant, nutritive (Mushroom, Truffle,) often poisonous (Amanita, Ergot.)
Without a mycelium.
  Terrestrial.—*Lichenes*, dye (Archil,) nutritious (Iceland and Reindeer moss, Tripe de Roche.)
  Aquatic.—*Algæ*, nutritive (Irish moss, Laver, Dulse.)

XVII.—DIVISION OF THE ORDER FILICES.

1. Polypodiaceæ. Acrogenous plants with distinct annulate thecæ or sporangia, growing on the back or edge of the fronds, and opening irregularly to discharge spores. Polypodium, Acrostichum, Hemionitis, Phlebodium, Pleopeltis, Cheilanthes, Adiantum, Pteris, Blechnum, Scolopendrium, Aspidium, Asplenium, Davallia, Dicksonia, Hemitelia, Cyathea, Parkeria, Trichomanes, Gleichenia, Aneimia, Lygodium, Osmunda.
2. Danæaceæ. Thecæ exannulate, united in masses, and opening irregularly by a central cleft. Danæa, Marattia, Kaulfussia.
3. Ophioglossaceæ. Thecæ exannulate, distinct, two-valved, formed on the margin of a contracted leaf. Ophioglossum, Botrychium.

XVIII.—ANALYSIS OF THE BRITISH GENERA OF FERNS.

- I. Thecæ annulate.
  - 1. Annulus or ring complete.
    - *a.* Vertical.
      - Indusium absent.
        - Sori oblong or linear.—***Ceterach.***
        - Sori roundish.—***Polypodium.***
      - Indusium present.
        - Distinct from the frond.
          - Sori nearly circular.
            - Indusium orbicular fixed by centre.—***Polystichum.***
            - Indusium reniform fixed by sinus.—***Lastrea.***
            - Indusium opening by free extremity, towards apex of frond. —***Cystopteris.***
            - Involucre cut at the edges into capillary segments.—***Woodsia.***
          - Sori oblong or linear.
            - Indusium opening towards midrib.
              - Sori oblong, reniform.—***Athyrium.***
              - Sori linear straight.—***Asplenium.***
            - Indusium double, with a longitudinal suture.—***Scolopendrium.***
        - Formed by the frond.
          - Sori marginal.
            - Linear.—***Pteris.***
            - Oblong-roundish.—***Adiantum.***
            - Circular and at length confluent.—***Allosorus.***
          - Sori longitudinal on each side of midrib.—***Blechnum.***
    - *b.* Horizontal.
      - Thecæ on an elongated monophyllous receptacle.—***Trichomanes.***
      - Thecæ on a narrow two valved receptacle.—***Hymenophyllum.***
  - 2. Annulus or ring incomplete.
    - Thecæ pedicellate, clustered.—***Osmunda.***

- II. Thecæ exannulate.
  - Thecæ in a simple distichous compact spike, frond undivided.—***Ophioglossum.***
  - Thecæ in a compound spike, frond divided.—***Botrychium.***

XIX.—DIVISION OF THE ORDER MUSCI.

- A. Acrocarpi, seta terminal.
  - 1. Astomi, operculum adherent to theca, no peristome.
    - Andræa, Phascum.
  - 2. Gymnostomi, operculum deciduous, mouth of theca naked.
    - Sphagnum, Gymnostomum, Anectangium, Schistostega.
  - 3. Peristomi, operculum deciduous, mouth of capsule having a peristome.
    - *a.* Aploperistomi, peristome single. Splachnum, Weissia, Dicranum, Polytrichum, Didymodon, Tortula, Trichostomum, Encalypta, Grimmia.

b. Diploperistomi, peristome double. Funaria, Orthotrichum, Bryum, Bartramia, Buxbaumia.

B. Pleurocarpi, seta lateral.
  1. Gymnostomi, mouth of theca naked. Hedwigia.
  2. Peristomi, mouth of theca with a peristome.
    a. Aploperistomi, peristome single. Pterogonium, Leucodon.
    b. Diploperistomi, peristome double. Neckera, Daltonia, Hookeria, Hypnum.

XX.—DIVISION OF THE ORDER LICHENES, (LINDLEY.)

1. Parmeliaceæ. Nucleus bearing asci; thallus heterogeneous, pulverulent or cellular.

2. Collemaceæ. Nucleus bearing asci; thallus homogeneous, gelatinous or cartilaginous.

3. Graphidaceæ. Nucleus breaking into naked spores.

Another Division.

1. Hymenothalameæ. Shields open; nucleus forming a disk, permanent, and bearing asci. Lecidea, Cladonia, Stereocaulon, Parmelia, Sticta, *Cetraria*, Roccella, Ramalina, Evernia, Usnea.

2. Gasterothalameæ. Shields always closed, or opened by the irregular separation of the covering of thallus; nucleus enclosed, containing asci, deliquescing or shrivelling up. Verrucaria, Endocarpon.

3. Idiothalameæ. Shields closed at first, afterwards open; nucleus gelatinous, made up of naked spores. Opegrapha, Graphis, Urceolaria, Umbilicaria.

4. Coniothalameæ. Shields or apothecia open; nucleus breaking up into naked spores. Pulveraria, Calycium.

XXI.—DIVISION OF THE ORDER ALGÆ.

1. Characeæ. Tubular plants, often encrusted with carbonate of lime, giving off regularly arranged branches, and propagated by the agency of globules and nucules, the latter being a spiral-formed germinating body, and containing starch. Chara, Nitella.

2. Fucoideæ or Fucaceæ (Melanospermeæ.) Cellular or tubular plants, usually of an olive-green or olive-brown colour, irregular in their forms, and propagated by simple spores which are developed externally. Fucus, Laminaria, Sargassum, Alaria, Cystoseira, Halidrys, Desmarestia, Punctaria, Dictyota, Padina.

3. Florideæ or Ceramiaceæ (Rhodospermeæ.) Unsymmetrical plants, usually of a rose or purplish-red colour, composed of cells or tubes variously disposed, propagated by tetraspores. Ceramium, Ptilota, Iridæa, Gelideum, Polysiphonia, Rhodomenia, Plocamium, Delesseria.

4. Confervoideæ or Confervaceæ (Chlorospermeæ.) Filamentous or membranous cellular plants, usually of a green colour, increasing by division of cells, or propagated by sporidia or zoospores formed in the interior from

their colouring matter. Conferva, Zygnema, Achlya, Ulva, Porphyra, Oscillatoria, Protococcus.

5. Diatomaceæ. Cellular brittle plants, composed of angular fragments or frustules, and propagated by spontaneous division. Diatoma, Isthmia, Meridion, Licmophora, Achnanthes, Xanthidium, Desmidium.

XXII.—DIVISION OF THE ORDER FUNGI, (LINDLEY.)

1. Hymenomycetes or Agaricaceæ. Spores generally quaternate, (Tetraspores,) on distinct sporophores, hymenium naked. Agaricus, Amanita, Boletus, Polyporus, Merulius, Clavaria.

2. Gasteromycetes or Lycoperdaceæ. Spores generally quaternate on distinct sporophores, hymenium enclosed in a peridium. Phallus, Clathrus, Lycoperdon, Geaster, Bovista, Diderma, Craterium, Nidularia, Sphærobolus.

3. Coniomycetes or Uredinaceæ. Spores single, often septate, on more or less distinct sporophores, flocci of the fruit obsolete or mere peduncles. Stilbospora, Torula, Puccinia, Uredo, Æcidium.

4. Hyphomycetes or Botrytaceæ. Spores naked, often septate, thallus floccose. Ceratium, Tubercularia, Fusarium, Aspergillus, Botrytis, Penicillium, Monilia, Oidium, Fusisporium.

5. Ascomycetes or Helvellaceæ. Sporidia, generally eight together, contained in asci. Morchella, Helvella, Geoglossum, Peziza, Tuber, Sphæria, Onygena.

6. Physomycetes or Mucoraceæ. Spores surmounted by a vesicular veil or sporangium, thallus floccose. Antennaria, Mucor, Rhizomorpha, Byssus, Mycoderma, Erineum, Sclerotium, Spermoedia.

XXIII.—ESTIMATED NUMBER OF KNOWN SPECIES OF PLANTS ON THE GLOBE.

Linnæus,......	1753	5323 Phanerog.	615 Cryptog.	5938
Persoon,.......	1807	19,949	6000	25,949
Steudel,.......	1824	39,684	10,965	50,649
Steudel,.......	1841	78,000	13,000	91,000
Steudel,.......	1844	80,000	15,000	95,000

ESTIMATE OF GENERA AND SPECIES BY LINDLEY IN 1846.

Thallogens,.........	939 Genera,	8394 Species.
Acrogens,...........	310	4086 ......
Rhizogens,..........	21	53 ......
Endogens,...........	1420	13,684 ......
Dictyogens,........	17	268 ......
Gymnogens,........	37	210 ......
Exogens,.........	18,062	55,911 ......
Total,	20,806	82,606

XXIV.—Botanical Stations.

1. Maritime or saline plants. These are terrestrial plants which grow on the border of the sea or of salt lakes, and require salt for nourishment, as *Salicornia* or glasswort, *Salsola* or saltwort, and some species of *Statice* or sea-pink.

2. Marine plants, such as seaweeds, lavers, &c., which are either buried in the ocean or float on its surface; also sea wracks (*Ruppia* and *Zostera*.)

3. Aquatic plants, growing in fresh water, either stagnant or running; as *Sagittaria* or arrowhead, *Nymphœa* or water-lily, *Potamogeton* or pondweed, *Subularia* or awlwort.

4. Marsh or swamp plants, living in ground which is generally submerged, but occasionally dry; as *Ranunculus aquatilis* and *sceleratus* or water and celery-leaved crowfoot, *Polygonum amphibium* or amphibious persicaria. The form of the plants varies according to the degree of moisture

5. Meadow and pasture plants; as some species of *Lotus* or bird's-foot trefoil, a great number of grasses, trefoils, &c.

6. Plants found in cultivated fields. In this division are included many plants which have been introduced by man along with grain; as *Centaurea Cyanus*, corn blue-bottle, *Sinapis arvensis* or common wild mustard, *Agrostemma* corncockle, several species of *Veronica* or speedwell, *Euphorbia* or spurge.

7. Rock or wall plants; as saxifrages, wall-flower, some species of *Sisymbrium* or hedge-mustard and *Bromus* or brome-grass, *Linaria cymbalaria* or ivy-leaved toadflax, *Draba muralis*, mosses.

8. Sand plants; as *Carex arenaria* or sea-carex, and *Calamagrostis arenaria* or sand small-reed, which tend to fix the loose sand, *Plantago arenaria* sand plantain, &c.

9. Plants of *Sterile* places, found in barren tracts, by roadsides. This is a heterogeneous class, and contains many plants of uncertain characters; under it are included plants of dry moors, where our heaths abound.

10. Plants found on rubbish, or those which select the habitations of men and animals, on account of the salts and azotized substances which enter into their composition; as *Parietaria* or pellitory of the wall, nettles, docks, and some Fungi.

11. Forest plants, including trees which live in society, as the oak, the beech, firs, &c., and the plants which grow under their shelter, as the greater part of the European orchises, some species of carex, broom-rape, &c.

12. Plants of the thickets or hedges, comprehending the small shrubs which constitute the hedge or thicket, as the hawthorn and sweet-briar; and the herbaceous plants which grow at the foot of these shrubs, as *Adoxa* or tuberous moschatell, wood sorrel, violets; and those which climb among their numerous branches, as bryony, black bryony, honeysuckle, traveller's joy, and some species of *Lathyrus*.

13. Subterranean plants, or those which live in mines and caves, almost entirely excluded from the light, as *Byssus*, truffles, and some other cryptogamic plants.

14. Plants of the mountains, which Decandolle proposes to divide into two sections: 1. Those which grow on alpine mountains, the summits of which are covered with perpetual snow, and where during the heat of summer there

is a continued and abundant flow of moisture, as numerous saxifrages, gentians, primroses, and rhododendrons. 2. Those inhabiting mountains on which the snow disappears during summer, as several species of snap-dragon, among others the alpine snap-dragon, umbelliferous plants, chiefly belonging to the genus *Seseli* or meadow saxifrage, labiate plants, &c.

15. Parasitic plants, which derive their nourishment from other vegetables, and which, consequently, may be found in all the preceding situations; as the misletoe, broom-rape, dodder, *Loranthus Rafflesia*, and a number of *Fungi*.

16. Pseudo-parasitic plants, or Epiphytes, which live upon dead vegetables, as lichens, mosses, &c., or upon the bark of living vegetables, but do not derive nourishment from them, as *Epidendrum*, *Aerides*, and other air-plants.

17. Plants which vegetate in hot springs, the temperature of which ranges from 80 to 150 of Fahrenheit's thermometer; as *Vitex Agnus castus*, and several cryptogamous plants, as *Ulva thermalis* the hot-spring laver.

18. Plants which are developed in artificial infusions or liquors, as various kinds of mouldiness.

XXV.—SCHOUW'S PHYTO-GEOGRAPHIC REGIONS.

1. The Region of *Saxifragaceæ* and *Musci*, or the Alpine Arctic Flora.—This region is characterized by the abundance of mosses and lichens, the presence of the saxifrage, gentian, and chick-weed tribes, sedges and willows; the total absence of tropical families; a notable decrease of the forms peculiar to the temperate zone; by forests of fir and birch; the small number of annual plants, and the prevalence of perennial species; and finally, a greater liveliness in their simple colours. The region is divided into two provinces: 1. The province of the *Carices* or the Arctic Flora, which comprehends all the countries within the polar circle, with some parts of America, Europe and Asia which are to the south of it, more especially Lapland, the north of Russia, Siberia, Kamtschatka, New Britain, Canada, Labrador, Greenland, and the mountains of Scotland and Scandinavia, mean temperature 66° to 41.°: 2. The province of Primroses and Rampions, or the Alpine Flora of the south of Europe, which embraces the flora of the Pyrenees, Switzerland, the Tyrol, Savoy, the mountains of Greece, the Appenines, and probably the mountains of Spain. Mean temperaturo, 47° to 36°.

2. The Region of *Umbelliferæ* and *Cruciferæ*.—These tribes are here in much greater number than in any other region; *Rosaceæ, Ranunculaceæ, Fungi, Amentaceæ*, and *Coniferæ*, likewise very numerous; the abundance of *Carices*, and the fall of the leaves of almost all the trees during winter, form also the chief features of this division. It may be separated into two distinct provinces: 1. The province of the *Cichoraceæ*, which embraces all the north of Europe, not comprehended in the preceding region, namely, Britain, the north of France, the Netherlands, Germany, Denmark, Poland, Hungary, and the greater part of European Russia: 2. The province of the *Astragali* and *Cynarocephalæ*, which includes a part of Asiatic Russia, and the countries about the Caucasian and Altai mountains. Mean temperature, 36° to 57°.

3. The Region of *Labiatæ* and *Caryophyllaceæ*, or the Mediterranean Flora.—It is distinguished by the abundance of the plants belonging to these two orders. *Compositæ, Galiaceæ, Boraginaceæ* also occur in considerable quantity. Some tropical families are also met with, such as Palms, Laurels, *Araceæ*

Terebinthaceæ, grasses belonging to the genus *Panicum* or millet, and the true *Cyperaceæ* or sedges. *Solanaceæ*, *Malvaceæ*, *Leguminosæ*, *Urticaceæ*, and *Euphorbiaceæ* increase. The forests are composed chiefly of the amentaceous and coniferous tribes, as birches, oaks, &c., the copses of *Ericaceæ* or heath tribe, and *Terebinthaceæ*, as the mastich. We meet in this region with a great number of evergreen trees. Vegetation never ceases entirely, but verdant meadows are more rare. Schouw divides this region into five provinces :—1. The province of the Cistuses, including Spain and Portugal; 2. The province of the Sage and Scabious, the south of France, Italy and Sicily; 3. The province of the Shrubby *Labiatæ*, the Levant, Greece, Asia Minor, and the southern part of the Caucasian countries; 4. The Atlantic province, the north of Africa, of which he does not yet know any distinctive character; 5. The province of *Semperviva*, the Canary Isles, and probably also the Azores, Madeira, and the north west coast of Africa; many houseleeks, and some spurges with naked and spiny stems particularly characterize this province. *Erica arborea*, and *Pinus canariensis* are found here. Mean temperature 54° to 72°.

4. The Region of *Asters* and *Solidagos*.—This is marked by the great number of species belonging to these two genera, by the great variety of oaks and firs, the small number of *Cruciferæ* and *Umbelliferæ*, *Cichoraceæ* and *Cynarocephalæ*, the total absence of the genus *Erica* or heath, and the presence of more numerous species of *Vaccinium* or whortleberry than are to be met with in Europe. It comprehends the whole of the eastern part of North America, with the exception of what belongs to the first region. It has been divided into two provinces :—1. That of the south, which embraces the Floridas, Alabama, Mississippi, Louisiana, Georgia, and the Carolinas; 2. That of the north, which includes the other states of North America, such as Virginia, Pennsylvania, New York, &c. Mean temperature 54° to 72°.

5. The Region of *Magnolias*, comprising the most southern parts of North America. The tropical forms which show themselves more frequently than on a similar parallel of the old continent, are the chief feature in the vegetation. Thus we meet with *Anonaceæ*, *Sapindaceæ*, *Melastomaceæ*, *Cactaceæ*, and *Zingiberaceæ*. This region has fewer *Labiatæ* and *Caryophyllaceæ* than occur in corresponding latitudes in the Old World. It presents more trees with fine blossoms and shining, sometimes pinnated, leaves, as Magnolia, Tulip tree, Horse-chesnut, False Acacias or Robinias. Mean temperature 59° to 72°.

6. The Region of *Camelliaceæ* and *Celastraceæ*, or the Japanese region.—This region is as yet too little known to enable us to determine accurately its characteristic features. It embraces the eastern temperate part of the old continent, namely Japan, the north of China, and Chinese Tartary. Its vegetation appears to occupy a middle place between that of Europe, and that of North America, approaching more to the tropical than to the European. It has an affinity to the Indian Flora, as shown by the occurrence of Bananas, Palms, *Zingiberaceæ*, *Anonaceæ*, *Sapindaceæ*, and *Cycadaceæ*. We meet with *Eriobotrya japonica* or Loquat, Tea, and various species of *Citrus*. Mean temperature 54° to 68°.

7. The Region of *Zingiberaceæ*, or the Indian Flora.—*Zingiberaceæ* here are much more numerous than in America, as well as *Leguminosæ*, *Cucurbitaceæ*, and *Tiliaceæ*, although in a less degree. In consequence of the imperfect state of our knowledge, we cannot subdivide this region into provinces. It comprehends India, east and west of the Ganges, the island of Ceylon and the south-eastern Peninsula, to the height of 4500 to 5500 feet above the level

of the sea. Ginger, Cinnamon, Mangosteen, Peppers, Indigo and Cotton, are met with. Mean temperature 65° 75′ to 81° 50′.

8. The Emodic Region, or the Mountains of India.—This comprises the Alpine region south of the ridge of the Himalaya. It includes Sirmore, Gurwal, Kamaon, Nepal, and Bhotan, to a height of from 4500 to 10,700 feet above the level of the sea. Some tropical plants grow in the lower parts of the region. Deodar, *Pinus excelsa*, *Webbiana,* and other *Coniferæ* are met with. Mean temperature 66° to 37°.

9. The Region of the Asiatic islands.—This includes the mountainous districts of the islands between the south-eastern Peninsula and Australia, to the height of 5500 feet above the level of the sea. Here we meet with the Dammar, Nutmeg, and Camphor tree. Mean temperature 66° to 84°.

10. The Region of Upper Java.—This embraces those districts of the island of Java and the islands of the Indian Archipelago, which have an elevation of 5500 feet above the level of the sea. The vegetation of this region has not been sufficiently ascertained.

11. The Polynesian Region.—This includes all the islands of the Pacific ocean within the Tropics. Here we find the Bread-fruit tree, Coco-nut, and Double Coco-nut. Mean temperature 72° to 82°.

12. The Region of *Amyridaceæ*, or of Balsam trees.—This comprehends the Persian or Arabian flora; especially the south-western part of the highlands of Arabia or Yemen. In this region are many trees yielding gums and balsamic resins, as species of *Mimosa, Acacia*, *Balsamodendron*, *Boswellia.* We also find the Coffee tree, Peach, Apricot, and sensitive plant.

13. The Desert Region.—This includes Northern Africa to the south of the mountains of Atlas, and the northern part of Arabia. *Phœnix dactylifera* or the Date-Palm, and *Cucifera thebaica* or Doom Palm, are found here, but little is known in regard to the vegetation of the region. Mean temperature 72° to 86°.

14. The Region of Tropical Africa.—This includes that part of Africa lying between the parallel of 15°, and the tropic of Capricorn, or between the northern and southern limits of periodical rains, with the exception of Abyssinia and the unknown countries of the interior. The Flora of the western part of this region is characterized in part by the presence of *Adansonia* or the Boabab, the largest known tree. We also meet with the *Elais guineensis,* a palm which furnishes oil. The vegetation of Guinea and Congo is a mixture of the floras of Asia and America, though most resembling the former. The eastern part of the region, including Madagascar, has a peculiar flora distinguished chiefly by the genera *Danais*, *Ambora, Dombeya, Dufourea*, *Didymomeles*, and *Senacea.* Mean temperature 72° to 86°.

15. The Region of *Cactaceæ* and *Piperaceæ.*—This embraces Mexico, New Grenada, Guiana, and Peru. These natural orders are here predominant, both as regards the number of species and the individual plants. Murichi or Ita Palm, *Phytelephas* or Ivory Palm, and *Victoria regia* are peculiar to Guiana. Mean temperature 68° to 84°.

16. The Region of the Highlands of Mexico.—This embraces the districts which have an elevation of more than 5500 feet above the level of the sea. Many European plants are cultivated here. *Pinus religiosa* and other *Coniferæ* are found. Mean temperature 78° to 64°.

17. The Region of *Cinchonæ*, or Medicinal Barks.—This comprises a part of the elevated regions or Cordilleras of South America, included in the torrid

zone, the Andes from 5500 to 9000 feet. The *Cinchona* belongs exclusively to this region, and forms its principal feature. In the higher regions the Potato and Quinoa are cultivated. Mean temperature 68° to 59°.

18. The Region of *Escalloniæ* and *Calceolariæ*.—It embraces the highest parts of South America, or that portion of the chain of the Andes, which has more than 9600 feet of elevation. Besides the plants mentioned, we meet with Alpine plants as Saxifrages and Gentians, and species of *Draba*, *Arenaria*, *Carex*, *Lobelia*, and *Salvia*, besides some European genera belonging to the orders *Gramineæ* and *Cichoraceæ*, such as *Bromus*, *Festuca*, *Poa*, *Apargia*, and *Hypochœris*. Mean temperature, 59° to 34°.

19. The West Indian Region.—This includes the whole district of the Great and Little Antilles. Bananas, Plantains, Mangos, Guava, Avocado pear, Tamarind, and many other useful plants are met with. The flora is intermediate between that of Mexico and the northern parts of South America. Mean temperature, 59° to 78°.

20. Region of *Palmæ* and *Melastomaceæ*.—It embraces Brazil and that part of South America which lies to the east of the chain of the Andes, between the Equator and the Tropic of Capricorn. Mean temperature, 59° to 82°.

21. The Region of Arborescent *Compositæ*.—The great number arborescent syngenesious plants, more particularly of the order *Calyceraceæ*, forms the chief feature of this flora, which approaches in a remarkable manner to that of Europe, whilst it differs entirely from those of Chili, the Cape, and New *Holland*. This region comprehends the lower part of the basin of La Plata, and the plains which extend to the west of Buenos Ayres and Chili, between the tropic of Capricorn and latitude 40° south. The flora of Chili approaches that of New Holland, the Cape of Good Hope, and New Zealand in *Goodenia*, *Araucaria*, *Proteaceæ*, *Gunnera*, *Ancistrum*. Mean temperature, 59° to 75°.

22. The Antarctic Region.—This includes the countries near the Straits of Magellan, Terra del Fuego, and the Falkland Islands. There is a considerable affinity between the vegetation here and what is seen in the north temperate zone. Polar forms also display themselves in the species of saxifrage, gentian, arbutus, and primrose. There is also a resemblance between the flora of this region, and those of the mountains of South America, of Chili, the Cape, and new Holland. *Fagus antarctica*, and Winter's Bark occur here. Mean temperature, 41° to 46°.

23. The Region of *Mesembryanthema* or Fig Marigolds, and *Stapeliæ*. These two genera, as well as the *Ericeæ* or heaths, are very abundant here. The latter family is found in greater quantity here than any where else. It embraces the southern extremity of Africa. *Iridaceæ*, *Pelargoniums*, *Aloineæ*, *Bruniaceæ*, and *Selaginaceæ*, and various *Gnaphaliums*, and *Elichrysums* occur in this region. Mean temperature, 55° to 73°.

24. The Region of *Epacridaceæ* and *Eucalypti*. It comprehends the temperate parts of New Holland and Australia beyond the tropics, with the island of Tasmania or Van Dieman's Land. Besides the two families whence it receives its name, it is characterized by the orders *Stackhousiaceæ* and *Tremandraceæ*, and by the presence of a great number of *Proteaceæ*, *Myrtaceæ*, *Stylidiaceæ*, *Restiaceæ*, *Diosmeæ*, *Casuarinaceæ*, *Acaciæ*. *Araucaria*, or *Altingia excelsa* the Norfolk island Pine, forms one of the features of the region. It is one of the most peculiar Floras. Mean temperature, 52° to 72°.

25. The Region of New Zealand. This flora, besides the plants peculiar to New Zealand, comprehends several others which belong to the extremities of

America, Africa, and Australia, or New Holland. We find in these islands *Corypha australis* the Australian or Southern Palm, Tree Ferns and *Dracœnas*, forests of *Dammara australis* one of the *Coniferœ*, and many *Myrtaceœ*.

XXVI. Zones of Vegetation,—illustrated by the Plants found at different elevations on high Equatorial mountains.

1.	The Region of Palms and Bananas.	Equatorial Zone.
2.	The Region of Tree Ferns and species of Ficus.	Tropical Zone.
3.	Myrtles and Lauraceæ.	Subtropical Zone.
4.	Evergreen trees.	Warm Temperate Zone.
5.	European Deciduous trees.	Cold Temperate Zone.
6.	Species of Pinus.	Subarctic Zone.
7.	Rhododendrons.	Arctic Zone.
8.	Alpine plants, Lichens.	Polar Zone.

XXVII. Fossiliferous Stratified Rocks (Ansted).

I. Palæozoic.	
Older Palæozoic.	Lower and Upper Silurian.
Middle Palæozoic.	Devonian and old Red Sandstone.
Newer Palæozoic.	Carboniferous system, Lower new Red Sandstone, and Magnesian Limestone or Permian System.
II. Secondary	
Older Secondary.	Upper new Red Sandstone or Triassic System.
Middle Secondary.	Liassic, Oolitic, Wealden.
Newer Secondary.	Cretaceous.
III. Tertiary.	
Lower Tertiary, or Eocene group.	
Middle Tertiary, or Miocene group.	
Newer Tertiary, or Pliocene group.	
Superficial Deposits, or Pleistocene group.	

XXVIII. Numerical Distribution of the Species of Fossil Plants in Different Strata (Goeppert, 1845).

Older and Middle Palæozoic,	52
Carboniferous,	819
Permian,	58
Triassic,	86
Oolitic,	234
Wealden,	16
Cretaceous,	62
Tertiary,	454
Unknown,	11
	1792